

PSYCHE.

NOTES ON THE ACRIDIDAE OF NEW ENGLAND.—I.

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The purpose of these notes on literature, morphology, habits, etc., is to add to the available knowledge of the species of locusts occurring in New England and enable others to more readily become acquainted with them. To this end the notes are accompanied by sketches illustrating many of the more important diagnostic characters, and keys for determining the species, which, it is hoped, will enable, so far as it is possible, even the novice to identify any specimen in hand.

The order of sequence of the various groups, if circumstances permit, will be that adopted by Brunner in his recent Revision.

PART I. TETTIGINAE.

Of this subfamily I have over nine hundred New England specimens in my collection, forming the basis of this

paper. To Mr. S. H. Scudder I am indebted for opportunity to examine other North American and several European species, and the types of the New England forms described by him.

In the bibliography references are given to the original descriptions and the more important and accessible literature only, with a view to clearly indicating the species to which reference is made. Unless otherwise stated I have accepted Scudder's determinations of the species described by Harris, Say, and Burmeister, as indicated in his "Materials." For the sake of brevity a list of works is given and reference is made in most cases to author and page only.

Under the head of measurements the extremes alone are given. "Total length" refers to the length of the insect from the front of the vertex or head to

EXPLANATION OF PLATE 6.

The drawings are numbered in accordance with the species.

Fig. 1. *Nomotettix cristatus*, side view of pronotum.

Fig. 1a. *Nomotettix cristatus*, var. *carinatus*, side view of pronotum.

Fig. 1b. *Nomotettix cristatus*, section.

" 1c. " " profile.

1d. " " head from above.

Fig. 2. *Tettix ornatus* and *triangularis*, pronotum and wings from above,—combination figure to show outlines of both forms.

Fig. 2a. *Tettix ornatus*, side view to show sinuses of lateral lobes.

Fig. 2b. *Tettix ornatus*, head from above.

" 2c. " " profile.

" 3. " *granulatus*, head from above.

" 3a. " " profile.

" 4. *Paratettix cucullatus*, head from above.

" 4a. " " profile.

" 5. *Tettigidea lateralis*, head from above.

the tip of the pronotum or wings, as the case may be.

"Pronotum > hind femora" means that the pronotum passes the end of the hind femora; if a quantity is preceded by a — sign, the pronotum fails to pass by that amount. All statements of a comparative character should be understood as having reference to New England species only.

BIBLIOGRAPHY.

Unless otherwise stated citations refer to the following works:—

BOLIVAR, IGN.—*Essai sur les Acridiens de la tribu des Tettigidae*,—*in* Ann. Soc. ent. Belgique, xxxi, 1887 (pp. 175-313). (This can be obtained in separate form.)

FERNALD, C. H.—*The Orthoptera of New England*, pp. 61; *same*, in 25th Report Mass. agric. college (pp. 85-145), Jan. 1888; *same*, in Report Sec. Board agric. Mass., 1887 (pp. 421-481). The pagination of the separate is used.

HARRIS, T. W.—*A treatise on some of the insects injurious to vegetation*, 3rd ed., 1862 (pp. 165-191). First ed. pub. 1841.

MORSE, A. P.—*Wing-length in some New England Acrididae*,—*in* Psyche, 1894, pp. 13, 14, 53-55.

A preliminary list of the Acrididae of New England,—*in* Psyche, 1894, pp. 102-108.

(Separates of these are obtainable.)

SCUDDER, S. H.—*Materials for a monograph of the North American Orthoptera, including a Catalogue of the known New England species*,—*in* Boston journ. nat. hist., vol. vii, no. iii, 1862 (pp. 409-480).

THOMAS, CYRUS.—*Synopsis of the Acrididae of North America*. Rep't U. S. geol. surv. terr. (Hayden) vol. v., pt. 1, 1873,—pp. x, 262.

This group of locusts as found in New England comprises eight forms more or less distinct structurally and presenting great diversity in color and markings,—the latter are, however, of so comparatively little systematic value that I have not considered them in this paper, but hope to do so at some future time. The characters of most value in distinguishing the forms are the number of joints in the antennae, the form of the vertex and profile of the head, and of the pronotum, and the extent of the pronotum and wings.

The most recent work of a monographic character on this group is Bolivar's "Essay," which was based on the very large amount of material contained in several of the most important European collections. This excellent work is invaluable to the student and is likely to remain for some time the standard reference.

Bolivar divides the entire subfamily into seven sections, according to form of antennae, position of median ocellus, form of anterior femora, forking of frontal costa, form and direction of posterior angles of lateral lobes of pronotum, number of antennal joints, and relative length of proximal joints of posterior tarsi. New England affords representatives of but two of these—Tettigidae and Batrachideae.

To the Batrachideae belongs the genus Tettigidea with two forms—*T. lateralis* and *T. polymorpha*, while the remaining genera fall into the Tettigidae. These two sections may be

distinguished as follows: in the Tettigidae the anterior femora are carinate above, and the antennae are composed of 12-14 joints, while in the Batrachideae the anterior femora are sulcate above and the antennae are composed

of 16-22 joints, in our forms of 21-22. The number of joints frequently varies in the same species, sometimes being 13 in one specimen and 14 in another, or the same individual may have 13 in one antenna and 14 in the other.

KEY.

1. Pronotum normal, not covering abdomen; pulvilli present between the tarsal claws. Common locusts or "grasshoppers."
- 1¹. Pronotum covering all or nearly all of the abdomen; pulvilli wanting between the tarsal claws. "Grouse-locusts" or TETTIGINAE.
2. Antennae 12-14 jointed.
 3. Median carina high, crest-like, arched longitudinally. Superior lateral sinus of pronotum shallow, about one-half as deep as the inferior. (Gen. 1, *Nomotettix*.)
 4. Wings abortive, not equalling pronotum. Sp. 1, *N. cristatus*.
 - 4¹. Wings perfect, equalling or passing pronotum. Sp. 1, var. *carinatus*.
 - 3¹. Median carina low, dorsum rather flat. Superior lateral sinus nearly as deep as the inferior.
 5. Vertex of head projecting beyond eyes. (Gen. 2, *Tettix*.)
 6. Vertex rounded on front margin, and the median carina distinctly projecting. Profile rather deeply excavate opposite eyes. Sp. 2, *T. ornatus*.
 7. Wings large. Pronotum subulate behind. Sp. 2, type form, *ornatus*.
 - 7¹. Wings small, passing the hind thighs but little. Pronotum not subulate; sides of process nearly straight. Sp. 2, form *triangularis*.
 - 6¹. Vertex angulate on front margin. Profile shallowly excavate opposite eyes. Sp. 3, *T. granulatus*.
 - 5¹. Vertex of head not projecting beyond eyes. (Gen. 3, *Paratettix*) Sp. 4, *P. cucullatus*.
- 2¹. Antennae 21-22 jointed. (Gen. 4, Tettigidea.)
8. Wings perfect, when closed passing the hind thighs. Sp. 5, *T. lateralis*.
- 8¹. Wings abortive, not passing the hind thighs. Sp. 6, *T. polymorpha*.

I. TETTIGIAE.

known as *Batrachidea cristata* Harr. Bolivar has shown that this is more nearly allied to the Tettigiae than to the genus *Batrachidea* or the section

The first species of this section to claim attention is that most widely

containing it. I cannot agree with him, however, in considering it to belong to the same genus as *Tettix subulatus*, *granulatus*, etc., and propose for it a new generic appellation.

Form *carinatus*.

Batrachidea carinata Scudder, 479.

" " Scudd. Thomas, 190.

" " " Fernald, 49.

" " " = *Tettix cris-*

tatus Scudd. Bolivar, 260.

Batrachidea carinata Scudder = *B. cristata* Harr. Morse, 54.

Batrachidea cristata carinata Scudd. Morse, 107.

1. NOMOTETTIX gen. nov. (νομός, pasture; and τέτιξ).

Lateral lobes of the pronotum with the postero-dorsal sinus shallow, about one-half the depth of the antero-ventral sinus. Pronotum advanced upon the head, rather sharply tectiform. Occiput of head with a pair of nipple-like or mammillate protuberances between the posterior portion of the eyes and the median line. Type, *Tetrix cristata* Harris.

The type also differs from the group of species containing *Tettix granulatus* in having stouter hind femora and but 12, sometimes 13, joints in the antennae, instead of 14, frequently 13. It differs markedly in the character of its haunts, also, preferring dry soil to moist, upland pastures to meadows, whence the generic name.

1. *Nomotettix cristatus* Harr. Figs. 1, 1a, 1b, 1c, 1d.

Tetrix cristata Harr. Mss. } Scudder, 478.
Batrachidea cristata

" " Scudd. Thomas, 190.

" " Harr. Fernald, 48.

Tettix cristatus Scudd. Bolivar, 257, 260.

Batrachidea cristata Harr. Morse, 54, 107.

The two forms here treated as belonging to one species were considered and perhaps are still by some as distinct species. Bolivar in his "Essay" united the two under *T. cristatus* Scudd. [more properly Harris], but judging from his description of *B. carinata* he had never seen it and failed to comprehend the characters distinguishing it, mistaking for it certain specimens of the *cristatus* form. He states that the pronotum is longer than the abdomen, extending a little beyond the hind femora, its posterior point being "*inflected and directed downward*" (the italics are mine), and the median carina less strongly arcuate. This fits such specimens exactly, but does not apply to *carinatus*. *Carinatus* is quite rare, but one or two occurring to the hundred of *cristatus*; specimens of the other form are common although less plentiful than those in which the pronotum fails to reach the tip of hind femora. A glance at figs. 1 and 1a will at once enable the relation of *cristatus* and *carinatus* to be understood, *carinatus* having the wings perfectly developed and the pronotum elongated and slightly *upturned* at the

end to receive them; otherwise it is identical with *cristatus*.

I have already indicated (Psyche, 1894, 53, 54) my opinion of the relation of these two forms: that *carinatus* is but a reversion to the earlier long-winged type of female, such cases being not uncommon. This conclusion was reached independently, from examination of my material, before becoming acquainted with Bolivar's work.

Blatchley states (Can. ent. 1892, 33) that he regards *carinatus* and *cristatus* as distinct as the two forms of Tettigidea. Typically they are, but specimens intermediate in structure are met with in both cases, and in addition the great proportional rarity of the long-winged form is to be considered in this case. The following measurements showing the relations of pronotum, hind femora and wings will be of interest in this connection. Those of *carinatus* are based on but seven specimens, those of *cristatus* on a very large number.

Cristatus form.

Total length. Pron. Pron. > Hind fem. Wing < Pron.

♂	7.7-9.	7.1-8.5	-1. - + .5	.5-1.3
♀	5.6-10.2	5. -9.5	-.5- +1.	.7-2.

Carinatus form.

Total length. Pron. Pron. > Hind fem. Wing > Pron.

♂	11.-11.5	9.5-10.7	2.-3.	.4- .5
♀	11.-12.5	9.5-11.5	1.-2.5	.3-1.

One female *carinatus* has the pronotum extending but 1 mm. beyond the hind femora and the wings but .3 mm. beyond the pronotum, thus being inter-

mediate in structure, although approaching *carinatus* more closely. Looked at from above it can scarcely be distinguished from *cristatus*, but a glance at the side reveals the fully developed wings. The markings are identical in character, both forms being either plain or spotted. No difference is perceptible in the proportions of the hind femora as would be likely in the case of a winged and wingless species, nor in the vertex or the occiput which vary characteristically in this group.

Description.—Antennae 12 to 13 jointed, usually 12; occiput bearing a pair of nipple-like protuberances, very small but not to be confused with the granulations of the surface, one on each side opposite the hinder part of the eyes. These are distinct in even young specimens. Vertex projecting, rounded; its median carina high, projecting considerably in advance of the margin; frontal costa sharply excised opposite the eyes. Pronotum with anterior margin advanced upon the head, the sides excavate. Median carina cristate, arched longitudinally, higher opposite shoulders, gradually becoming lower toward the rear; its outline sometimes a little flattened just behind the shoulders. Dorsal sinus of lateral lobe about $\frac{1}{2}$ as deep as the ventral sinus, its anterior margin only $\frac{1}{2}$ as long as the dorsal margin of the ventral sinus, its angle more or less obtuse or nearly right, the lobe between the two sinuses obtusely rounded. Hind thighs stout, the breadth contained $2\frac{1}{2}$ times in the length. Elytra longer and narrower than in our species of Tettix, acuminate at the apex.

Habits.—This curious little locust is the smallest Acridian and the commonest species of the subfamily occurring in New England and is widespread in distribution. It is common locally over

the larger part, at least, and probably occurs in the whole of the district. I have taken it at Fryeburg and Norway, Me., Jackson, N. H., and have received it from Brattleboro, Vt. (Mrs. J. B. Powers). In Mass. I have taken it at Beverly, Winchendon, Wellesley and several towns in its vicinity; in Connecticut at Thompson; and off shore on Martha's Vineyard, and Block Island, R. I. It is most plentiful in April, May and October, but I have taken it in every month in the year except November, in which also it can doubtless be found. I have taken young specimens in Mass. in October,—common, of small or medium size, and in June about half-grown; in northern Vermont in the middle of July—very small and one in the last stage.

The *carinatus* form is very rare. I have captured but nine specimens, at Beverly, April 24, and at Wellesley, Mass., April 10, 13, Oct. 6. These were in company with the *cristatus* form, five being secured in one afternoon in a locality where the latter was particularly abundant, and two in another locality under similar conditions.

Outside New England Blatchley reports the species as rare in Indiana; I have received it from western Penn'a; Bolivar reports it from Georgia, and I have recently seen a specimen from Florida.

It is found everywhere on light soils, but especially in dry pastures and other wild land sparsely covered with a scanty growth of curling tufts of *Danthonia* grass, scraps of *Cladonia* lichens

and the leathery leaves of *Antennaria*. It is perhaps somewhat more plentiful in the damper portions of such localities, but differs much from the other species of the subfamily in this particular, the others preferring soils perpetually moist or even the shores of lakes or streams. This difference in habits as well as structure lends weight to the argument for generic distinction, and the name proposed alludes to this preference.

Search in such situations in early spring and late fall is almost certain to result successfully. I have generally found it easiest to secure by sweeping as close to the ground as possible, dragging the net, as it were, rapidly along on the ground. Where abundant it is found advantageous to abandon the net and crouch or even to go over the ground on the hands and knees. In localities where it is plentiful it is practicable to capture 50–200 specimens in an afternoon within the area of a few square rods.

2. TETRIX Charp.

Tettix Charpentier 1841. Germar. Zeitschr. III. 315, equivalent to *Tetrix* Latreille, Hist. Nat. d. Crust. Ins. XII, 161–164.

2. *Tettix ornatus* Say. Figs. 2, 2a, 2b, 2c.

Acrydium ornatum Say, 1824. Amer. entom., i, pl. v.

Acridium ornatum Say, 1859. Ent. N. A., ed. Lec., i, 10.

Tettix ornata Say. Scudder, 474.

“ “ Scudd. Thomas, 183.

“ *ornatus* Say. Fernald, 46.

“ “ Scudd. Bolivar, 258, 264.

“ “ Say. Morse, 54, 106.

Not *Tetrix arenosa* Burm. Scudder, 474.

Form *triangularis* Scudd.

Tettix triangularis Scudder, 475.

"	"	Scudd.	Thomas, 185.
"	"	"	Fernald, 47.
"	"	"	Bolivar, 258, 265.
"	"	"	Morse, 54, 107.

This is a very variable species in both structure and ornamentation and has consequently been described under several names, while an unfortunate typographical or mechanical error has caused further confusion. Scudder, in the original description of *triangularis* gave the length of the pronotum as .17 inch; this has been copied by Thomas, Fernald, and Bolivar, and perhaps others. This is just one-half its usual length in that form, and the error was quite likely of mechanical origin. Bolivar evidently describes this form under the name of *ornatus* while doubting the specific distinctness of *triangularis* which was unknown to him! At least, this seems to be the only interpretation possible to place upon his table of species and the dimensions given under *T. ornatus*.

Description, etc.—The following measurements will be of interest in this connection. I believe that the two forms are but one species, as stated in *Psyche*, 1894, p. 54, since they are indistinguishable except in length of pronotum and wings, and intergrade in those particulars, and so have not attempted to keep their measurements separate.

Total length. Pron. Pron. > Hind fem. Wgs. vs. Pron.

♂ 8.3-12.5	7.5-10.8	0-3.4	-.5-+1.
♀ 9.-13.5	8.-12.	0.-3.5	-.5-+1.5

As is here shown the pronotum is very variable in length, in some only reaching the end of hind femora, in others passing it by 3.5 mm.; and the wings are equally variable, and usually least developed proportionally in those specimens with the shortest pronota. It is impossible to draw any line between the two forms *ornatus* and *triangularis*, although the typical forms are quite distinct. Of 124 specimens in my collection a little over two-fifths are nominally referred to the *triangularis* form, and the sexes are evenly divided in both forms. Nor is there any difference in seasons or haunts.

The species is readily recognizable from the characters of the vertex. This projects in front of the eyes, is somewhat rounded anteriorly and the mid-carina forms a distinct projecting tooth. The profile is rounded-angularate above, excavate opposite the eyes and protuberant opposite the antennae. Very rarely a specimen is met with in a dorsal or a profile view approaches *T. granulatus* closely, but any doubt of its identity is usually dispelled by an examination of it from both directions.

Habits, etc.—This species is found most commonly in moist sedgy meadows and swales, often in company with *T. granulatus*, but is also frequently met with in damp places on drier grounds, uplands, etc. At no time plentiful, it seems to be most common in spring and fall but I have captured it in every month from April to October. I have specimens from Fryeburg, Me., Aug. 20, Hanover, N. H., Sept. (C. M. Weed), Newport, and Jay, Vt., July 13, 15, Brattleboro, Vt., April 17-May 14 (Mrs. J. B. Powers), New Haven, Conn., Aug. 29, Beverly, Mass., April 24, Green Lodge Sta., June 14, Sher-

born, April and Sept., and from Wellesley in April, May, June, July, Sept., and Oct. I have but a few nymphs which were taken in July, Aug., and Sept.

It seems to be less active and alert than its congener *granulatus*. My specimens were secured by sweeping.

3. *Tettix granulatus* Kirby. Figs. 3, 3a.

Acrydium granulatum Kirby, 1837.
Faun. Bor. Am., Ins., 251.

Tettix granulata Kirby. Scudder, 474.

" " Scudd. Thomas, 182.

" *granulatus* Kirby. Fernald, 46.

" " " Bolivar, 259,

265.

Tettix granulatus Kirby. Morse, 54, 106.

Bolivar states that this species is very similar to *T. bipunctatus* L. of Europe. From a comparison with specimens of the latter species (determined by Brunner) in Mr. Scudder's collection this is a serious error. *T. bipunctatus* is closely allied to our *Nomotettix cristatus*, probably belonging to the same genus. Bolivar's descriptions, figure and localities lead me to think that possibly he has described this species as new under the name of *T. brunneri* and applied *granulatus* to *T. acadicus* Scudd.

Description, etc.—Anterior border of vertex considerably advanced in front of eyes, angulate, the apex very slightly rounded, or rarely with the mid-carina projecting a trifle. In profile the face is quite retreating, the vertex considerably advanced, sinuate opposite the eyes, and moderately protuberant opposite antennae. The eyes are the least prominent in this of any of our species, and

the body more slender. It is liable to be mistaken for *T. ornatus* only, but the outlines of profile and vertex, considered together, need leave no doubt of the species. It bears considerable resemblance to *T. subulatus* of Europe..

Measurements are as follows:—

Total length. Pron. Pron. > Hind fem. Wgs. vs. Pron.			
♂ 9.7-13.5	8.6-11.5	1.2-3.5	— .3- +1.
♀ 13.5-15.3	12. -13.5	3. -4.3	— .5- +1.

In one ♂ the pronotum is but 1.2 mm. longer than the hind femora and the wings are .3 mm. short of end of pronotum. This is extremely small but other examples from the same locality grade up to the usual size.

Habits, etc.—This is one of the most common and widely spread species of the group, sometimes locally plentiful. It is found over probably the whole of New England, and far west and north. While most plentiful in spring and fall, adults can probably be found every month in the season. I have specimens from New England as follows:—

Fryeburg, Me., Aug. 20, numerous.

Brattleboro, Vt., April 17, 1 spec. (Mrs. J. B. Powers).

Jay, Vt., July 16, several small and one half-grown young.

Beverly, Mass., April 24, numerous.

Newtonville, Mass., July 26, 1 young.

Provincetown, Mass., Sept. 4-8, 1 yg., 4 adults; scarce.

Sherborn, Mass., April and Sept., scarce.

Wellesley, Mass., April 4-30, plentiful. May 19, 27, numerous. June 24, yg., half-grown. July 18, 1 ♂. Aug. 1, yg., half-grown. Sept., 1 ♀.

Winchendon, Mass., July 5, 1 ♂.

Block Island, R. I., Aug. 28, numerous.

(To be continued.)